Claims

[c1] 1.A magnetic pole piece for a magnetic resonance imaging ("MRI") system, said pole piece comprising a stack of a plurality of sheets of an alloy that comprises iron and aluminum, said sheets being laminated together.

[c2] 2.The magnetic pole piece for a MRI system according to claim 1, wherein said alloy comprises from about 0.5 to about 17 weight percent aluminum.

[c3] 3.The magnetic pole piece for a MRI system according to claim 2, wherein said alloy further comprises cobalt in an amount from about 0.1 weight percent to about 10 weight percent.

[c4] 4.The magnetic pole piece for a MRI system according to claim 2, wherein said alloy further comprises nickel in an amount from about 0.1 weight percent to about 10 weight percent.

[c5] 5.The magnetic pole piece for a MRI system according to claim 2, wherein said alloy further comprises silicon in an amount from about 0.1 weight percent to about 4 weight percent.

[c6] 6.The magnetic pole piece for a MRI system according to claim 3, wherein said alloy further comprises silicon in an amount from about 0.1 weight percent to about 4 weight percent.

[c7] 7.The magnetic pole piece for a MRI system according to claim 4, wherein said alloy further comprises silicon in an amount from about 0.1 weight percent to about 4 weight percent.

[c8] 8.The magnetic pole piece for a MRI system according to claim 1, wherein each of said sheets has a thickness less than about 0.5 mm.

[c9] 9.The magnetic pole piece for a MRI system according to claim 1, wherein each of said sheets has a thickness less than about 0.3 mm.

[c10] 10.The magnetic pole piece for a MRI system according to claim 1, wherein each of said sheets has a thickness less than about 0.1 mm.

[c11] 11.The magnetic pole piece for a MRI system according to claim 1, wherein said sheets are separated from each other by an electrically insulating material.

[c12] 12.The magnetic pole piece for a MRI system according to claim 10, wherein said electrically insulating material is selected from the group consisting of inorganic and organic electrically insulating materials.

[c13] 13.The magnetic pole piece for a MRI system according to claim 10, wherein said electrically insulating material is a silicate.

[c14] 14.The magnetic pole piece for a MRI system according to claim 10, wherein said electrically insulating material is an organic polymeric material selected from the group consisting of epoxy resins, acrylic resins, polyorganosilanes, polyorganosiloxanes, polysilazanes, silicon polymers that have -Si-N- bonds, and mixtures thereof.

[c15] 15.The magnetic pole piece for a MRI system according to claim 10, wherein said electrically insulating material is a residue resulting from a heat treatment of a polymer selected from the group consisting of polyorganosilanes, polyorganosiloxanes, polysilazanes, silicon polymers that have -Si-N- bonds, and mixtures thereof.

[c16] 16.The magnetic pole piece for a MRI system according to claim 1, wherein said sheets have a resistivity greater than about 60 micro-ohm.cm, as measured according to ASTM standard A712-97.

[c17] 17.The magnetic pole piece for a MRI system according to claim 1, wherein said sheets are laminated at a pressure up to about 100 MPa.

[c18] 18.The magnetic pole piece for a MRI system according to claim 1, wherein said sheets are laminated with an organic binder at a melting temperature thereof.

[c19] 19.The magnetic pole piece for a MRI system according to claim 18, wherein said sheets have been annealed before being laminated together.

[c20] 20.The magnetic pole piece for a MRI system according to claim 1, wherein said stack is annealed at a temperature from about 900^{0} C to about 1300^{0} C.

[c21] 21.The magnetic pole piece for a MRI system according to claim 1, wherein said stack is annealed at a temperature from about 1000^{0} C to about 1200^{0} C in an environment selected from the group consisting of vacuum, reducing gas atmosphere, inert gas atmosphere, and combinations thereof.

[c22] 22.A magnetic pole piece for a MRI system, said pole piece comprising a plurality of stacks, each of said stack comprising a plurality of sheets of an alloy that comprises iron and aluminum, said sheets being laminated together, said stacks being disposed adjacent one another such that sheets of one stack are oriented at an angle relative to sheets of an adjacent stack.

[c23] 23.A magnetic pole piece for a MRI system, said pole piece comprising a stack of a plurality of sheets of an alloy that comprises iron and aluminum, said sheets being laminated together, each of said sheet being formed in a process comprising:

forging a block of said alloy at a temperature in a range from about 1000^{0} C to about 1300^{0} C to produce a forged alloy;

hot rolling said forged alloy at a temperature of about 1300^{0} C to produce a hot-rolled body; and

cold rolling said hot-rolled body using a thickness reduction increment from about 10 percent to about 50 percent to produce said sheet.

[c24] 24.The magnetic pole piece for a MRI system according to claim 23 further comprising performing a first annealing of said hot-rolled body at a temperature from about 900^{0} C to about 1050^{0} C before said cold rolling.

[c25] 25.The magnetic pole piece for a MRI system according to claim 24, wherein said annealing is carried out for a time between about one hour and about 24 hours.

[c26] 26.The magnetic pole piece for a MRI system according to claim 23 further comprising performing a second annealing of said sheet after said cold rolling, said annealing being carried out in an environment selected from the group consisting of vacuum, reducing gas, inert gas, and combinations thereof.

[c27] 27.The magnetic pole piece for a MRI system according to claim 26 further

comprising performing a second cold rolling after said second annealing.

[c28] 28.A MRI system comprising at least a magnetic pole piece that comprises a stack of a plurality of sheets of an alloy that comprises iron and aluminum, said sheets being laminated together.

[c29] 29.The MRI system according to claim 28, wherein said alloy comprises from about 0.5 to about 17 weight percent aluminum.

[c30] 30.The MRI system according to claim 28, wherein said alloy comprises from about 0.5 to about 10 weight percent aluminum.

[c31] 31.The MRI system according to claim 28, wherein each of said sheets has a thickness less than about 0.5 mm.

[c32] 32.The MRI system according to claim 29, wherein said alloy further comprises cobalt in an amount from about 0.1 weight percent to about 10 weight percent.

[c33] 33.The MRI system according to claim 29, wherein said alloy further comprises nickel in an amount from about 0.1 weight percent to about 10 weight percent.

[c34] 34.The MRI system according to claim 29, wherein said alloy further comprises silicon in an amount from about 0.1 weight percent to about 4 weight percent.

[c35] 35.The MRI system according to claim 32, wherein said alloy further comprises silicon in an amount from about 0.1 weight percent to about 4 weight percent.

[c36] 36.The MRI system according to claim 33, wherein said alloy further comprises silicon in an amount from about 0.1 weight percent to about 4 weight percent.

[c37] 37.The MRI system according to claim 28, wherein each of said sheets has a thickness less than about 0.5 mm.

[c38] 38.The MRI system according to claim 28, wherein each of said sheets has a thickness less than about 0.3 mm.

[c39] 39.The MRI system according to claim 28, wherein each of said sheets has a thickness less than about 0.1 mm.

[c40] 40.The MRI system according to claim 28, wherein said sheets are separated from each other by an electrically insulating material.

[c41] 41.The MRI system according to claim 40, wherein said electrically insulating material is selected from the group consisting of inorganic and organic electrically insulating materials.

[c42] 42.The MRI system according to claim 40, wherein said electrically insulating material is a silicate.

[c43] 43.The MRI system according to claim 40, wherein said electrically insulating material is an organic polymeric material selected from the group consisting of epoxy resins, acrylic resins, polyorganosilanes, polyorganosiloxanes, polysilazanes, silicon polymers that have -Si-N- bonds, and mixtures thereof.

[c44] 44.The MRI system according to claim 40, wherein said electrically insulating material is a residue resulting from a heat treatment of a polymer selected from the group consisting of polyorganosilanes, polyorganosiloxanes, polysilazanes, silicon polymers that have -Si-N- bonds, and mixtures thereof.

[c45] 45.The MRI system according to claim 28, wherein said sheets have a resistivity greater than about 60 micro-ohm.cm, as measured according to ASTM standard A712-97.

[c46] 46.The MRI system according to claim 28, wherein said sheets are laminated at a pressure up to about 100 MPa.

[c47] 47.The MRI system according to claim 28, wherein said sheets are laminated with an organic binder at a melting temperature of said organic binder.

[c48] 48.The MRI system according to claim 28, wherein said stack is annealed at a temperature from about 900^{0} C to about 1300^{0} C.

[c49] 49.The MRI system according to claim 28, wherein said stack is annealed at a temperature from about 1000^{0} C to about 1200^{0} C.

[c50] 50.The MRI system according to claim 28, wherein said stack is annealed in an environment selected from the group consisting of vacuum, reducing gas, inert

gas, and combinations thereof.

[c51] 51.A process for making sheets of a magnetic alloy comprising iron and aluminum, said process comprising:

forging a block of said alloy at a temperature in a range from about 1000 ^{0}C to about 1300 ^{0}C to produce a forged alloy;

hot rolling said forged alloy at a temperature of about 1300 ^{0}C to produce a hot-rolled body; and

cold rolling said hot-rolled body using a thickness reduction increment from about 10 percent to about 50 percent to produce said sheet.

[c52] 52.The process for making sheets of a magnetic alloy comprising iron and aluminum according to claim 51 further comprising performing a first annealing of said hot-rolled body at a temperature from about 900 ^{0}C to about 1050 ^{0}C before said cold rolling.

[c53] 53.The process for making sheets of a magnetic alloy comprising iron and aluminum according to claim 52, wherein said annealing is carried out for about one hour.

[c54] 54.The process for making sheets of a magnetic alloy comprising iron and aluminum according to claim 52 further comprising performing a second annealing of said sheet after said cold rolling.

[c55] 55.The process for making sheets of a magnetic alloy comprising iron and aluminum according to claim 54 further comprising performing a second cold rolling after said second annealing.